IN THE SPECIFICATION:

**[0006]** (Currently amended) The present approach provides a leadscrew drive and a method for its fabrication. The leadscrew has an extremely low mass while achieving high torsional and axial strengths. The leadscrew is flexible in bending but stiff in ~~axially~~ axial loading, as required for optimal leadscrew mechanical performance in light-duty and medium-duty applications. The bending flexibility reduces the sensitivity of the leadscrew drive to misalignments. The structure of the leadscrew also aids in isolating the driven component from vibrations in the motor. The leadscrew drive may be readily miniaturized, and retains its advantages in the miniature form.

**[0022]** (Currently amended) Figure 1 depicts a leadscrew drive 20. The leadscrew drive includes an elongated leadscrew 22 having a helical external thread-form 24 that is engaged to a conforming internal thread (not visible) of a leadscrew follower 26. The leadscrew 22 is rotationally driven by a motor 28. As the leadscrew 22 rotates, the engagement of its external thread-form 24 to the conforming internal thread of the leadscrew follower 26 causes the leadscrew follower 26 to move linearly parallel to a longitudinal axis 30 of the elongated leadscrew 22. A driven component 32 is affixed to the leadscrew follower 26, and moves with the leadscrew follower. (Equivalently, the leadscrew follower 26 may be fixed in position, so that the leadscrew 22 and the motor 28 move parallel to the longitudinal axis 30 as the leadscrew 22 turns.)

**[0023]** (Currently amended) In the present approach and as shown in Figures 2-3, the leadscrew 22 comprises an elongated annular leadscrew shell 34 whose outer surface 36 has the helical thread-form 24 (although that thread-form 24 is not readily discernible in Figures 2-3 and is more clearly seen in Figures 6-7). The annular leadscrew shell 34 is preferably fabricated by a deposition process discussed subsequently. The annular leadscrew shell 34 may have any operable annular thickness. When the preferred deposition process is used, the annular thickness of the annular leadscrew shell 34 may be quite small. A ratio t/D of an annular thickness t of the

annular leadscrew shell 34 to a cylindrical outer diameter D of the annular leadscrew shell may be not more than 0.01, and in some cases not more than 0.001. This construction places the leadscrew-shell material that comprises the leadscrew shell 34 at a maximum distance from the longitudinal axis 30, for maximum strength in the torque loading required of the leadscrew 22 while achieving minimal mass and inertia of the leadscrew shell 34.

**[0024]** (Currently amended) The elongated annular leadscrew shell 34 may be completely hollow in its interior, and therefore has no core support, as shown in Figure 2. The elongated annular leadscrew shell 34 may instead have a core support 38, as shown in Figure 3. The nature of the specific type of core support 38 illustrated in Figure 3 will be discussed subsequently in relation to the fabrication method.

**[0025]** (Currently amended) The elongated annular leadscrew shell 34 may be made of any operable material. Preferably, the elongated annular leadscrew shell 34 is made of a metal, and specifically a nickel-base metal. The "nickel-base metal" contains more nickel than any other metallic element, and may be substantially pure nickel, a nickel-alloy (e.g., nickel-copper, nickel-phosphorus with phosphorus at various concentrations according to the desired properties, or nickel-aluminum), or a composite material having a non-metal (e.g., polytetrafluoroethylene particles) embedded in a metallic matrix (e.g., pure nickel or a nickel alloy).

**[0026]** (Currently amended) Figure 4 depicts in block diagram form a preferred method for making the leadscrew drive 20. The leadscrew 22 is fabricated, step 50. The fabrication 50 includes first providing a mandrel having a thread-form outer surface, step 52. Figure 5 illustrates a preferred form of the mandrel 70. This mandrel 70 is preferably prepared as a wire-wound mandrel by helically winding a round wire 72 of a material such as aluminum onto a cylindrical rod 74, and affixing the wire 72 in place to the rod 74, as with a spot weld or an adhesive. In this preferred embodiment, the turns 76 of the wire 72 are closely adjacent to each other in the axial direction 30 of the leadscrew 22, and preferably are touching. The turns 76 of the helically wound wire 72 may instead be well spaced apart from each other, as shown in the embodiment of Figure 7. These turns 76 of the helically wound wire 72 define the thread-form outer

surface 78 of the mandrel 70. The mandrel 70 may instead be prepared by a conventional machining or rolling of the thread-form outer surface on a solid rod or a hollow tube. This alternative approach is not preferred for the fabrication of small-diameter leadscrews, the preferred application of the present approach, because it is difficult to machine or roll such small diameter rods that have a thin wall.

**[0029]** (Currently amended) Electroless plating is an immersion plating wherein a chemical reducing agent changes metal ions to metal. The electroless plating of a stand-alone article may also be termed electroless forming, by analogy with electroforming. A number of different metals, in pure, alloy, or composite form, may be deposited by electroless deposition. Such deposition processes are known in the art for other applications. In a typical case, nickel-base metal may be deposited from a nickel-sulfate solution by reduction with sodium hypophosphite, by the chemical reaction

$$NiSO_4 + 2\ NaH_2PO_2 + 2\ H_2O \rightarrow Ni + 2\ NaH_2PO_3^- + H_2 + H_2SO_4.$$

Nickel-base alloys are deposited by including a co-reducible species in the solution that contains the alloying elements. Composites such as polytetrafluoroethylene particles in a nickel-base matrix may be deposited by introducing the particles into the solution so that they are captured in the nickel-base metal matrix as it deposits.

**[0034]** (Currently amended) Optionally, after the deposition step 54, the mandrel 70 may be removed in whole or in part, step 56. Because the electroless deposition may be performed on a nonmetallic mandrel 70, the mandrel may be made of plastic, foam, and other similar materials that are readily removed by heating to vaporize the mandrel materials and/or dissolution to dissolve the mandrel materials. If the removal step 56 is not performed and none of the mandrel 70 is removed, the leadscrew 22 may have the cross-sectional construction shown in Figure 3, with both the annular leadscrew shell 34 and the core support 38 present. If the removal step 56 is performed to remove all of the mandrel 70 and thence all of the core support 38, the leadscrew 22 has the hollow cross-sectional construction shown in Figure 2. An

intermediate approach may be followed, where only a part of the mandrel 70 is removed, for example removing the rod 74 and leaving the wire 72 in place. The mandrel rod 74 may instead be initially supplied as a hollow tube, so that the leadscrew 22 is hollow after the deposition 54. Removing all or part of the mandrel 70, or otherwise using a hollow mandrel, reduces the strength and stiffness of the annular leadscrew shell 34 parallel to the longitudinal axis 30, but also reduces the bending stiffness perpendicular to the longitudinal axis 30. The selection of the cross-sectional construction of the leadscrew 22 is made responsive to the mechanical requirements of the particular application of the leadscrew drive 20.